**Introduction**

The released radionuclides after the Chernobyl accident were transported by moving air masses over Lithuania. Of particular importance were radioiodines. Measurements of radioactive iodine on the first day after the accident showed that $^{131}$I concentration in the air was 10 times higher above the normal range. The weather resulted different exposure of Lithuanian regions to the fallout (Fig. 1).

Measurements of $^{131}$I in cows’ milk at that time showed that its concentration didn't increase above standard ranges ($370$ Bq/l) in Central and Northern regions in contrast to $3700\pm660$ Bq/l in Southern and Western regions. In result, mean adults equivalent thyroid doses estimated by determinant method, were $1,2$ mSv in Northern regions, $9,1$ mSv in Western and Southern regions. They were correspondingly $10$ mSv and $77$ mSv for children [1].

Fig.1 Lithuanian regions affected by $^{131}$I after the Chernobyl accident:
A - $^{131}$I concentration in cows’ milk in normal ranges (<370 Bq/l).
B - $^{131}$I concentration 370 - 1000 Bq/l.
C - $^{131}$I concentration more than 1000 Bq/l.
There is no investigations giving objective data about the Chernobyl accident impact on thyroid disorders in Lithuania. It is of great importance when 9 years passed since the Chernobyl accident and it is known that the latent period between thyroid irradiation and discovery of thyroid cancer has been as long as 5 yrs, thyroid nodules (adenomas) - 10 yrs [2].

The aim of study was to investigate the prevalence of adult thyroid disorders in 2 Lithuanian regions - Varena and Kupiškis, taking into consideration different degree of radioiodine pollution after Chernobyl accident in these regions.

**Subjects and methods**

Randomly selected Varena and Kupiškis residents aged 25 - 26 yrs were examined. They were divided into equal groups according to age and sex. Totally 415 subjects in Varena and 320 subjects in Kupiškis were investigated. Questionary, clinical examination, thyroid palpation, ultrasonography was performed and thyroid volume was measured. Blood was taken for radioimmunoassay of plasma fT₄, TSH and thyroid microsomal antibodies. Urine was collected for measurement of iodine excretion. Fine-needle aspiration biopsy was performed when needed. Thyroid size was estimated by inspection and palpation according to WHO [3].

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>No goiter</td>
</tr>
<tr>
<td>IA</td>
<td>Goiter palpable but not visible</td>
</tr>
<tr>
<td>IB</td>
<td>Visible at reclined head only</td>
</tr>
<tr>
<td>II</td>
<td>Goiter visible</td>
</tr>
<tr>
<td>III</td>
<td>Very large goiter, visible from a distance</td>
</tr>
</tbody>
</table>

The ultrasonography was performed using real-time “Toshiba” SAL - 328 with 5MHz transducer. The thyroid volume was calculated as described by Brunn et al [4]. Thyroid palpation and ultrasonography were performed by 2 same physicians in both regions.

Thyroid microsomal antibodies were detected by passive haemagglutination method. 1 80 and higher titres were considered to be positive.

Urine iodine concentration was measured by Ceric-arsenite method in casual urine sample. The samples were collected in tubes with screw tops and were refrigerated. The measurements were performed in the Institute of Radiation Medicine in Minsk (Belarus).

![Fig.2. Prevalence of thyroid function disorders in Varena (n=415) and Kupiškis (n=320) residents](image-url)

- subclinical thyroid disorder
Results and Discussion

95(22.9%) of 415 subjects in Varena had thyroid enlargement according to palpation and ultrasonography data. Thyroid nodules were diagnosed in 17 cases (4.1%). In 10 cases of nodular thyroid abnormalities more than 1 cm in diameter fine-needle aspiration biopsy was carried out and in 1 case thyroid carcinoma was diagnosed.

In Kupiskis 77(24.1%) of 320 subjects showed to have thyroid enlargement. Thyroid nodules were diagnosed in 17 cases (5.9%). After fine-needle aspiration biopsy 2 out of 11 subjects with nodular thyroid abnormalities showed to have thyroid carcinoma. There is no significant difference in the prevalence of goiter and nodules in subjects from these two regions.

Prevalence of thyroid function disorders is shown in the Fig.2.

According to ultrasensitive TSH and fT4 measurements hypothyroidism was diagnosed in 6 cases in Varena region (1.9%). Hyperthyroidism was diagnosed in 2 cases (0.6%). Prevalence of hypothyroidism in Kupiskis region was 3%, hyperthyroidism was diagnosed in 0.8% of the cases. There is no significant difference in the prevalence of thyroid function disorders in the two regions.

Measurements of the thyroid microsomal antibodies showed the increased titres (≥1.80) in 14.7% of subjects in Varena and 13.2% in Kupiskis region.

Iodine excretion in urine was measured in 40 urine samples from Varena region and in 85 samples from Kupiskis region. Mean iodine excretion in urine was 65.5±8.2 µg/l in Varena and 69.4±12.3 µg/l in Kupiskis. In non-iodine deficiency areas normal urinary iodine concentration is >100 µg/l; 50-100 µg/l urinary iodine concentration is modest iodine deficiency, 20-50 µg/l - moderate and <20 µg/l - severe iodine deficiency [5]. Thus, the results indicate the problem of iodine deficiency in Lithuania [6]. It is known that the thyroid absorbs larger doses of radioactive iodine in iodine deficiency areas during atomic power accident. Establishment of iodine deficiency in Varena enabled to correct thyroid equivalent doses in this region after the Chernobyl accident [1]. Thyroid doses estimated by stochastic method are presented in Table I.

<table>
<thead>
<tr>
<th></th>
<th>Doses (mSv)</th>
<th>&lt;100</th>
<th>100 - 200</th>
<th>200 - 300</th>
<th>300 - 400</th>
<th>&gt;400</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distribution (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Children</strong></td>
<td></td>
<td>22</td>
<td>59</td>
<td>16</td>
<td>2.3</td>
<td>0.7</td>
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<tr>
<td><strong>Doses (mSv)</strong></td>
<td></td>
<td></td>
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<tr>
<td>Adults</td>
<td></td>
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<tr>
<td><strong>Distribution (%)</strong></td>
<td></td>
<td>28</td>
<td>55</td>
<td>14</td>
<td>2.4</td>
<td>0.6</td>
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</table>

Table I Distribution of thyroid equivalent doses for children and adults after the Chernobyl accident in Varena region.

Table I summarises that only in 28% of the cases thyroid dose for adults were less than 10 mSv and in greater part of Varena population (55%) it was 10-20 mSv. Until the study was performed it was supposed that thyroid dose for children had been 73±10 mSv in Varena. Our study proved thyroid dose for children to be a lot higher: 100-200 mSv in 59% of the cases and there might be some cases of thyroid dose higher than 500 mSv. Literature reports that prevalence of thyroid nodules increases within increasement of thyroid equivalent dose above 400 mSv. In the study of Belarus children, exposed to
radioactive fallout (thyroid dose 2-5 Sv), occurrence of thyroid nodule according to ultrasonographic findings was 12-16% In 50% of them thyroid cancer was detected. In a control group, selected from Breslau region, that was presumed to have received little or no fallout from the Chernobyl accident, thyroid nodules were diagnosed in 1.6-2% of the examined children. There were no cases of thyroid carcinoma.

For comparison, in Varena region we have examined 362 children, born in 1985-86 yrs. Thyroid palpation and ultrasonography were performed. Thyroid nodules were found in 4 of 362 children (1.1%). The results of fine-needle aspiration biopsy of nodules didn't show any signs of malignisation. According to our results there is no increase in prevalence of childhood thyroid disorders.

The aim of the study was to compare prevalence of thyroid disorders in 2 Lithuanian regions with high and low levels of radioiodine pollution after the Chernobyl accident. Thus, Kupiškis ( $J^{131}$ concentration in cow's milk < 370 Bq/l) and Varena ( $J^{131}$ concentration > 1000 Bq/l) were chosen. The results proved that there is no significant difference in the prevalence of thyroid disorders in this two regions at the time.

**Acknowledgements**

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**References**


